NON-PUBLIC?: N
ACCESSION #: 9207090182
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Trojan Nuclear Plant PAGE: 1 OF 05

DOCKET NUMBER: 05000344

TITLE: Reactor Trip Caused by a Failure of a Manual Pushbutton on a Steam Generator Feedwater Regulating Valve Controller
EVENT DATE: 06/05/92 LER #: 92-014-00 REPORT DATE: 07/06/92

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 030

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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Engineer

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: JB COMPONENT: FCO MANUFACTURER: W120
REPORTABLE NPRDS: Yes

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

On June 5, 1992, the Trojan Nuclear Plant experienced a reactor trip. The plant had been operating at 30 percent power while preparing to shutdown for an unrelated condition. Feedwater to the 'B' steam generator was being controlled manually using its feedwater bypass valve.

Plant personnel were attempting to restore the steam generator water level control to automatic prior to initiating the shutdown. The operator stationed at the Steam Generator Water Level Control Panel in the Control Room began to open the 'B' main Feedwater Regulating Valve (FWRV) manually. The operator was not able to clear the open signal, which caused the steam generator to fill to its high-high level trip setpoint, causing a turbine trip/reactor trip. The cause of the controller failure was determined to be stuck contacts on a manual pushbutton on the controller. The failed controller was replaced with a

spare controller. The manual switches were removed from the failed controller and returned to the vendor for additional analysis. The failure of the pushbutton has been determined to be a random component failure caused by a manufacturing defect. In addition, operators were instructed concerning additional methods to terminate future similar controller failures. Plant systems responded as expected to the event. This event had no safety consequences.

END OF ABSTRACT

EVENT DESCRIPTION

On June 5, 1992, at 1823 hours PDT, the Trojan Nuclear Plant experienced a reactor trip. The plant had been operating at 30 percent power, while preparing to shutdown for an unrelated condition. Feedwater to the 'B' steam generator SB,SG! was being controlled manually, using its feedwater bypass valve. Manual control was required because the 'B' main Feedwater Isolation Valve (FWIV) had been out of service to repair a failed connector between the valve stem and the valve actuator.

Plant personnel were attempting to restore the 'B' steam generator water level control to automatic by transferring feedwater flow control from the bypass feedwater flow control valve to the 'B' Feedwater Regulating Valve (following repair of the FWIV) prior to initiating the shutdown. The operator stationed at the Steam Generator Water
evel Control Panel
started to open the 'B' Steam Generator's main Feedwater Regulating Valve (FWRV) JB,FCV! FCV-520 manually, using the Auto/Manual Station FK-520 (Westinghouse/Hagan Model Number 4111081) on the 'B' FWRV Controller JB,FC!. The operator was monitoring the feedwater flow and the FWRV demand signal as he started to open the FWRV and close the bypass valve. The operator noticed that feedwater flow and FWRV demand continued to increase after he stopped pushing the increase button on the Auto/Manual Station. Both feedwater flow and FWRV demand continued to increase after the operator pushed the decrease button on the FWRV Controller. Repeated attempts to close the FWRV manually failed. The operator closed fully the bypass feedwater control valve to reduce total feedwater flow.

The operator announced the problem with the FWRV to the Control Room. Shortly thereafter, a feed flow/steam flow mismatch alarm was received in the Control Room. Within approximately 47 seconds of receiving the feed flow/steam flow mismatch alarm, the Shift Manager ordered an auxiliary operator to close the 'B' Feedwater Isolation Valve (FWIV). The FWIVs cannot be remotely operated from the Control Room, so the operator had to

go to the local panel in the plant. Approximately 5 seconds after the FWIV started to close the turbine tripped on high-high steam generator level.

As a result of the controller failure, the water level in the 'B' steam generator rose to the high-high level trip setpoint. This resulted in a turbine trip, followed by a reactor trip at 1823 hours PDT. Plant systems functioned as required in response to the Reactor trip. The event duration, from when the operator started to open the 'B' FWRV until the turbine tripped, was approximately one minute.

The reactor trip was an RPS Actuation and was reported as required by 10 CFR 50.72 (b)(2)(ii), using the Emergency Notification System, at 1951 hours PDT on June 5, 1992. This report is being submitted to fulfill the requirements of 10 CFR 50.73 (a)(2)(iv).

CAUSE OF OCCURRENCE and EVENT ANALYSIS

The valve controller problem was caused by a random failure of the manual increase pushbutton JB,HS! on the Auto/Manual Station FK-520.

The output signal on Auto/Manual Station FK-520 continued to rise after the increase pushbutton was released, and continued to rise after repeated attempts to close the valve manually, using the decrease pushbutton. The output signal also remained high following the turbine trip. Troubleshooting performed on Auto/Manual Station FK-520, FK-510 ('A' FWRV), and a spare Auto/Manual Station verified that the problem was not caused by failure of an electronic component. Subsequent testing of FK-520 revealed that the contacts of the increase pushbutton would intermittently stick closed. While the contacts were stuck closed, placing the Auto/Manual Station in Auto caused the output signal to return to normal (the auto position overrides the manual input signal). Because the switch contacts are sealed and could not be visually examined, the exact cause of the intermittent problem could not be immediately determined.

The switches from FK-520 were returned to the vendor for additional analysis. These switches contain glass-encapsulated reed contacts which use a sliding magnet to pull the contacts into their closed position. A spring returns the magnet to its original position when the pushbutton is released, allowing the contacts to return to their open position Destructive examination performed by the vendor on the switches indicated that the magnet in the failed pushbutton was set approximately 1/16 inch closer to the reed contacts than in the other three switches. The vendor

determined that the proximity of the magnet to the contacts, when coupled with age-relaxation of the magnet's return spring, could prevent the magnet from moving far enough away from the reed switch to allow the contacts to return to their open position. The vendor concluded that this was what caused the intermittent failure of the switch. This is considered to be a random manufacturing defect in the switch, leading to a random component failure.

The PGE Event Review Team (ERT) that evaluated this event searched the Nuclear Plant Reliability Data System (NPRDS) database for 1972

to 1992, for past failures of westinghouse/Hagan Auto/Manual Stations in the nuclear industry. Results of this review indicated that only two pushbutton problems have been reported. The ERT confirmed this with the pushbutton manufacturer. Based on the low incidence of failure of this type of switch, coupled with the cause of the failure being a random manufacturing defect with one switch, it was determined that replacement of similar controllers or controller switches at Trojan is not justified for all controllers. However, some controllers are still being evaluated for replacement due to age-related concerns.

Since the operators knew that the steam generator level was rising and a turbine trip was eminent, two contributing factors were identified that prevented actions from being taken to prevent the trip. The first factor is that FWIV control is not provided in the Control Room. This increased the time required to respond to the Shift Manager's order to close the valve, time in which feedwater control using the feedwater bypass control valve possibly could have been re-established. The second factor is that the operator did not hold the decrease button down, or switch the controller to the Auto position. Either action would have stopped or slowed the feedwater flow, based on testing conducted after the event. However, although procedures do not prohibit either action, neither action is common practice. When the controller is in manual the increase and decrease pushbuttons are normally depressed only momentarily to provide small increases and decreases in flow, and are not held down for long periods. Similarly, the normal action is to place the controller in the manual position when the auto function fails, not the opposite. Therefore, neither factor is considered a cause of the event but did contribute to not being able to prevent the trip.

CORRECTIVE ACTIONS

1) The Auto/Manual Station FK-520 was replaced with a spare unit, and the Feedwater Regulating Valve FCV-520 was tested by cycling it

manually with the new unit prior to returning the valve to service.

2) The operators have been instructed that placing the Auto/Manual Station in Auto should be considered as a means for over-riding a failed manual pushbutton.

ANALYSIS OF SAFETY CONSEQUENCES AND IMPLICATIONS

There were no safety consequences from this event. This event generated a Reactor Protection System signal that resulted in a Reactor Trip. The plant responded as expected to the trip. Had the trip occurred from 100 percent power, instead of 30 percent, there would have still not been any safety consequences since the plant is designed to withstand a trip from 100 percent power, and the subject failure would not have prevented any emergency systems from functioning.

There are 19 other controllers of this design at Trojan, including the FWRV controllers for the other three steam generators. A pushbutton failure on several of these controllers could cause a reactor trip. since this was a random failure of a mechanical component, the potential exists for similar failures to occur on similar controllers in other plant systems. This failure is attributed to a random manufacturing defect. By their nature, random failures of individual components cannot be predicted. However, some controllers are being evaluated for replacement due to age-related concerns.

PREVIOUS SIMILAR EVENTS

One controller failure which resulted in a reactor trip occurred at Trojan in 1988, and was reported in LER 88-43. However, that event was attributed to a capacitor failure, not a pushbutton switch. There are no recorded incidents at Trojan of a controller failure caused by the failure of this type of switch.

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July 6, 1992

WRR-124-92

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington DC 20555

Gentlemen:

Licensee Event Report No. 92-14 is attached. This report discusses a Reactor Trip caused by the failure of a manual pushbutton switch on the controller for a Steam Generator Feedwater Regulating Valve.

Sincerely,

W. R. Robinson
General Manager
Trojan Nuclear Plant

c: Mr. John B. Martin
Regional Administrator, Region V
U.S. Nuclear Regulatory Commission

Mr. David Stewart-Smith
State of Oregon
Department of Energy

Mr. R. C. Barr
USNRC Resident Inspector
Trojan Nuclear Plant

LER Distribution

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